Pleistocene Frogs from Near Cooma, New South Wales

MICHAEL J. TYLER[1], ANGELA C. DAVIS[2] AND CRAIG R. WILLIAMS[1]

[1]Department of Zoology, University of Adelaide, SA 5005; and
[2]Department of Geology, Australian National University, Canberra, ACT 2600

TYLER, M.J., DAVIS, A.C. AND WILLIAMS, C.R. (1998). Pleistocene frogs from near Cooma, New South Wales. *Proceedings of the Linnean Society of New South Wales* **119**, 107–113.

Several frog limb fragments and six excellently preserved ilia were collected by one of us (A.C.D.) from the Jilliby Formation at the Bunyan Siding fossil locality, 8 km NNE of Cooma, New South Wales. The material forms part of the Bunyan Siding Fauna and has been dated by thermoluminescence dating and palaeomagnetic studies as Middle Pleistocene.

The frogs represent two extant species: the hylid *Litoria citropa* (Duméril and Bibron) and the leptodactylid (myobatrachid) *Limnodynastes peronii* (Duméril and Bibron). *Litoria citropa* is known from eastern Victoria and south-eastern New South Wales, whereas *Limnodynastes peronii* has a more extensive geographic range extending from eastern Queensland in a continuous arc to the south-east of South Australia and includes Tasmania.

This is the first fossil record of *L. citropa*, whereas *L. peronii* is known from the Holocene of Hunter Island in Bass Strait. Fossil frogs have been reported only once previously from New South Wales.

Manuscript received 17 February 1997, accepted for publication 20 August 1997.

KEYWORDS: Pleistocene, frogs, ilia, scapulae, *Limnodynastes*, *Litoria*, New South Wales.

INTRODUCTION

It was not until 1973 that the first fossil frog was discovered in Australia (Tyler 1974). Taken at Lake Palankarinna in northern South Australia, it was from a deposit initially considered to be Miocene, but subsequently argued to be of Oligocene age (Lindsay 1987).

Because the first fossil was an ilium, its identification required a comparative study of the ilia of all extant Australian genera, so permitting its resolution as a new genus (Tyler 1976). Subsequent examination of other Cainozoic deposits resulted in 32 fossil Australian species being known by 1994 (Tyler 1994), whilst Tyler et al. (1996) added *Litoria raniformis* to bring the total to 33.

Only one fossil frog species has been reported from New South Wales: *Limnodynastes dumerilii* from Lake Menindee (Tyler 1994). This finding is despite the fact that the extant fauna of the extreme south-east is rich, including representatives of seven genera: the hylid *Litoria* Tschudi and the leptodactylids (myobatrachids) *Limnodynastes* Fitzinger, *Crinia* Tschudi, *Mixophyes* Günther, *Neobatrachus* Peters, *Pseudophryne* Fitzinger and *Uperoleia* Gray.

Here we report the discovery by one of us (A.C.D.) of the second known fossil frog fauna from New South Wales. Several axial and limb fragments, including six frog ilia, were found in the northern Monaro Region. The fragments form part of the Bunyan Siding Fauna and are of Middle Pleistocene age (Davis 1996).

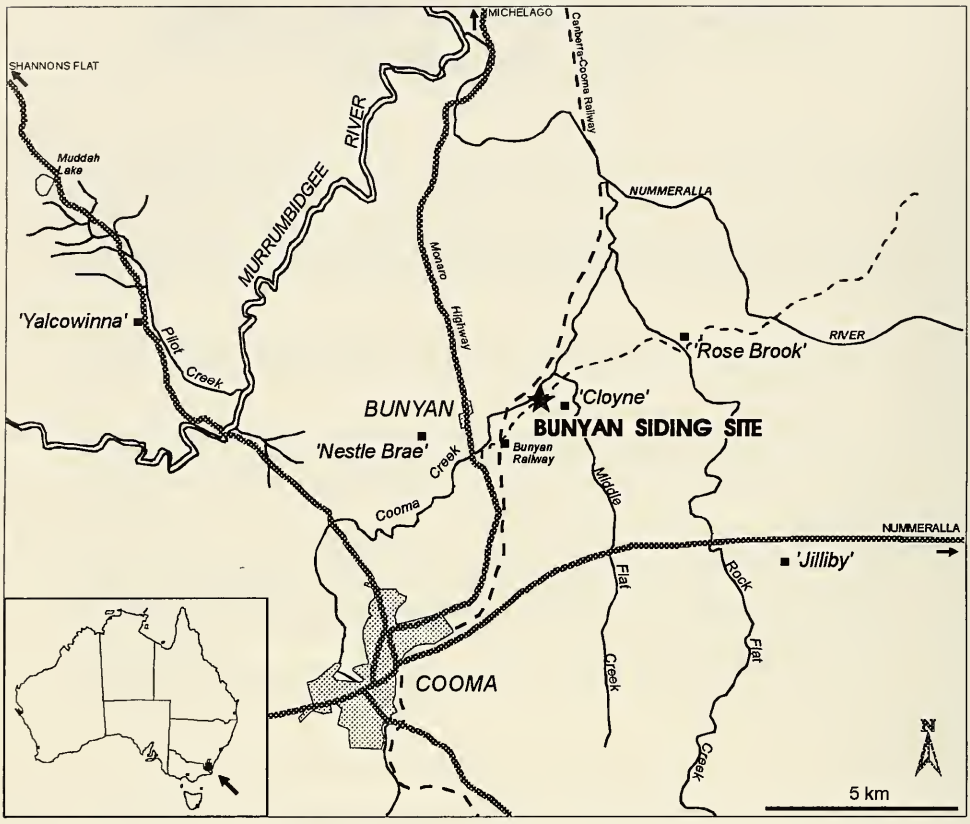

Figure 1. Locality map showing Bunyan Siding fossil site near Cooma, New South Wales.

LOCALITY AND STRATIGRAPHY

The frog specimens were found at the Bunyan Siding fossil locality, eight km NNE of Cooma (grid ref. 955961 on Cooma 1:100,000 sheet), south-eastern New South Wales (Fig. 1). The locality was first described by Ride et al. (1989) as a perched alluvial terrace deposit dissected by the present Rose Valley road. The site comprises two main Quaternary sedimentary units, the Jilliby Formation and the Nestle Brae Formation (Davis 1996).

The Jilliby Formation is at the base of the Quaternary sedimentary sequence and disconformably overlies lake clay facies of the Early Miocene Bunyan Formation defined by Taylor and Walker (1986). The unit comprises some 20 horizontal beds in a generally fining upward gravel/sand/clay sequence of 2 m thickness (Fig. 2). The basal bed, a coarse gravel, extends the length of the site (over 150 m) while overlying sand and clay beds lens out with lateral facies changes. The upper contact of the Jilliby Formation is an irregular erosional surface marked in places by a cemented calcrete horizon and infilled by sediments of the overlying Nestle Brae Formation, a reddish coloured sandy unit up to 1.5 m thick interbedded with small gravel lag deposits, with a well-developed red earth soil in the upper 40 cm (Davis 1996).

The Jilliby Formation facies sequence is interpreted as a large stream migrating across the valley, intermittently accreting channel, backswamp and flood plain facies, followed by a long period of surface stability with calcrete development and erosion (Davis 1996).

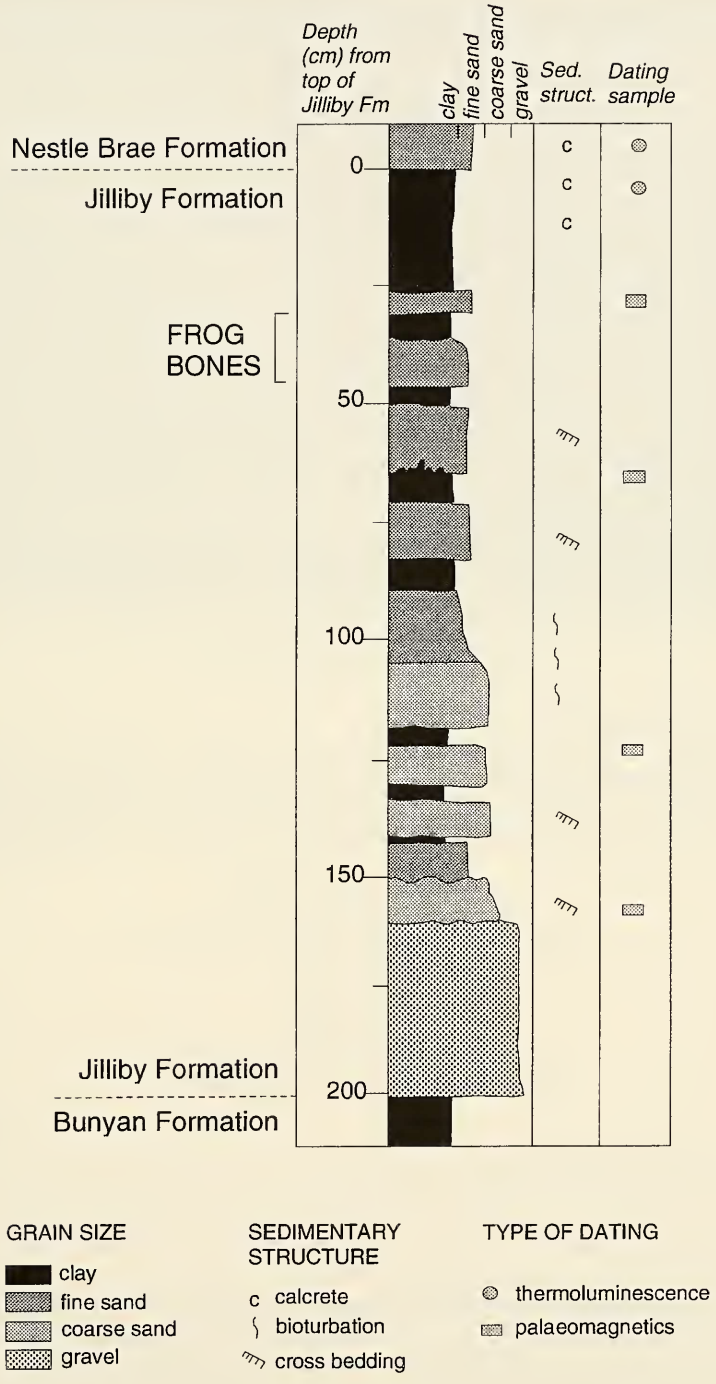

Figure 2. Stratigraphic log at Trench 11S, Bunyan Siding fossil site, near Cooma, New South Wales.

The majority of the Bunyan Siding Fauna and all of the frog material described in this paper were collected from the Jilliby Formation from a series of trenches excavated along the road cutting exposure. Three of the frog specimens (AM F98392–94) were collected in Trench 11S near the top of the unit in fine sandy clay facies (Fig. 2), while the remaining frog specimens were collected from Trench 11–12.5S (bed uncertain).

AGE AND ASSOCIATED FAUNA

A recent revision of the age of the locality (Davis 1996) indicates a Middle Pleistocene age for both the Jilliby and Nestle Brae Formations, not Late Pleistocene as previously thought (Ride et al. 1989). Thermoluminescence dating at the base of the Nestle Brae Formation and at the top of the Jilliby Formation (Fig. 2) indicate an age older than 100 ka, while palaeomagnetic samples from throughout the Jilliby Formation indicate Normal polarity implying an age within the Brunhes geomagnetic polarity stage (i.e. younger than 780 ka). Thus, the Bunyan Siding Fauna is interpreted as being of Middle Pleistocene age, but the position within the Middle Pleistocene is uncertain.

The Bunyan Siding Fauna comprises material from both stratigraphic units, full descriptions of which are provided in Davis (1996). In addition to the frog material described here, associated taxa include eighteen species of mammal, one species of freshwater fish and three species of reptile.

MATERIALS AND METHODS

The specimens reported here have been deposited in the palaeontological collection of the Australian Museum, Sydney.

The identifications are based upon comparative studies of ilia in the osteological collection held at the Department of Zoology at the University of Adelaide. Descriptive terminology follows Tyler (1976, 1989). Scanning electron micrographs were produced using a Joel 6400 SEM at the Electron Microscopy Unit (R.S.E.S.), Australian National University.

SYSTEMATICS

ORDER: Anura
FAMILY: Hylidae
SUBFAMILY: Pelodryadinae
Litoria citropa (Duméril and Bibron)

Material

Four ilia — AM F98391–94

Description

None of the specimens is complete but there is sufficient evidence to confirm their conspecificity and specific identity. Each of the specimens is illustrated in Fig. 3.

The dorsal prominence and dorsal protuberance of *L. citropa* are unusual, in being clearly demarcated by a narrow indentation surrounding the posterior and inferior boundaries of the protuberance. The dorsal acetabular expansion (DAE) superiorly is on a level with or slightly above the superior margin of the ilial shaft.

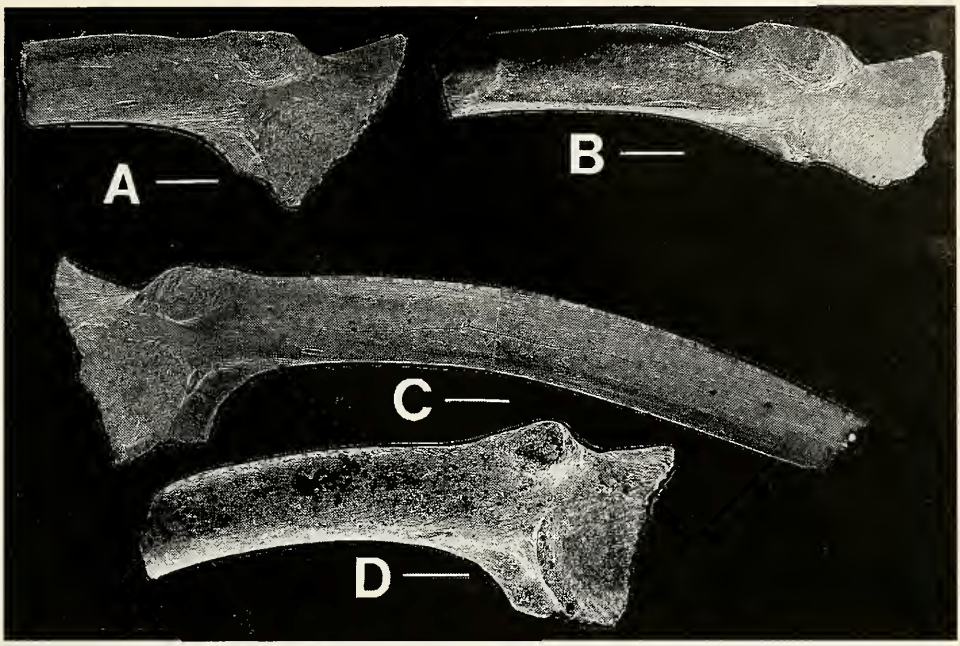

Figure 3. Fossil ilia of *Litoria citropa.* A. Australian Museum 98392, B. 98394, C. 98391, D. 98393. Scale bar = 1 mm.

The acetabulum is large and has a narrow, and clearly defined, circummarginal rim. The superior margin of the acetabular fossa extends slightly above the ventral margin of the ilial shaft. The preacetabular zone is broad and gently curved. The subacetabular zone is missing from all specimens. The ilial shaft is incomplete in all specimens.

FAMILY: Leptodactylidae[1]
SUBFAMILY: Limnodynastinae
Limnodynastes peronii (Duméril and Bibron)

Material

Two ilia — AM F98395–96

Description

All *Limnodynastes* species have an extremely large dorsal prominence and dorsal protuberance. In the case of *L. peronii* collectively these structures are huge, extending superiorly high above the dorsal rim of the ilial shaft (Fig. 4).

The dorsal acetabular expansion (DAE) is high but the base of this structure has coalesced with the dorsal prominence, and thus it appears small and even vestigial compared with congeners. Nevertheless, as in other *Limnodynastes* species, the anterior margin of the DAE rises steeply.

The acetabulum is relatively large, and the superior rim of the acetabular fossa extends above the ventral margin of the ilial shaft. The pre-acetabular zone is narrow, and the sub-acetabular zone is dilated into a spatulate form of which the inferior margin is incomplete.

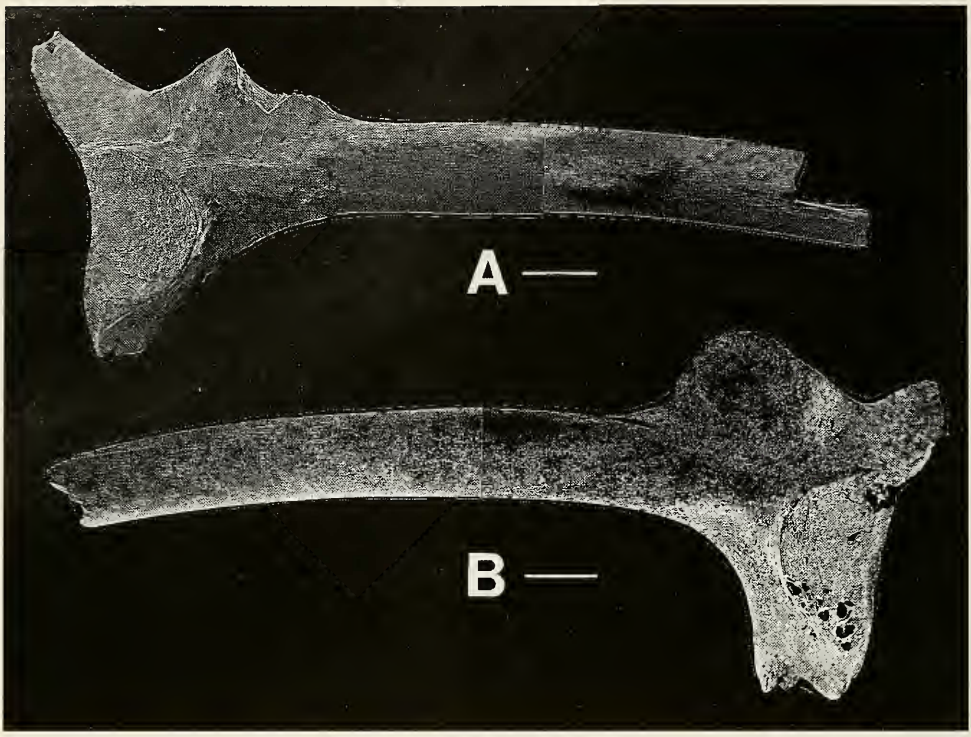

Figure 4. Fossil ilia of *Limnodynastes peronii*. A. Australian Museum 98396, B. 98395. Scale bar = 1 mm.

The distal end of the ilial shaft of AM F98395 is irregular, consistent with the interpretation that the shaft is complete, being replaced with cartilage at the position of its articulation with the sacrum. The total length of this specimen is 14 mm. The other representative (AM F98396) is a left ilium of a different individual with an incomplete ilial shaft and is also 14 mm long.

DISCUSSION

The geographic distribution of *L. citropa* has recently been revised by Anstis and Littlejohn (1996), and reveals an apparent gap of approximately 200 km northwards from the New South Wales-Victoria coastal border. The fossil site reported here is just within the northern portion of that gap, so bridging it slightly.

In the case of *Limnodynastes peronii* the site is well within the current geographic range of that species.

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ENDNOTE

[1] We persist with the use of the family name Leptodactylidae because of evidence of the lack of a single synapomorphy uniting the sub-families Myobatrachinae and Limnodynastinae within what is currently regarded as the Myobatrachidae. The inference is that further study will result in *Limnodynastes* and other limnodynastines being referred to a separate family. Accordingly, it is expedient to maintain conservatism of nomenclature rather than to include *Limnodynastes* in the Myobatrachidae, to which it evidently does not belong.